types of life among the older formations he contended to be no evidence in favour of development. It was simply negative evidence, and could at any moment be destroyed by the discovery of one positive fact in the shape of a bone, tooth, or other fragment. No one could make better use than he of such fortunate finds as that of Dr. Dawson among the ancient carboniferous forests of Nova Scotia, when from the heart of a fossil tree quite a little museum of land-snails and lizard-like forms was obtained; or those which revealed such remarkable assemblages of little marsupial and other mammalian forms from thin and local deposits like the Stonesfield slate and Purbeck beds. But negative evidence, when multiplied enormously by observers all over the world without any important contradiction, becomes too overwhelming to be explained away. Though convinced of the untenableness of the views of development which he opposed, Sir Charles may have had his misgivings at times that the yearly increasing and enormous body of negative evidence in favour of the non-existence of higher types of life in the earlier geological periods could not be due to the mere accident of non-preservation or non-discovery. At all events, when Mr. Darwin's views as to the origin of species were made known, Sir Charles, recognising in them the same basis of wide observation and the same methods of logical analysis for which he had himself all along contended in geology, at once and zealously accepted them—a bold and candid act, seeing that it involved the surrender of opinions which he had been defending all his life. In no respect did he show his remarkable receptive power and the freshness with which he had preserved his faculty of seeing the geological bearings of new truths more conspicuously than in the courage and skill with which he espoused Mr. Darwin's hypothesis and proceeded at once to link it with the general philosophy of geology.

Of his work among the Tertiary formations, with the nomenclature by which, through that work, they are now universally known, his observations on the rise of land in Sweden, his researches into the structure of volcanic cones, and other original contributions, over and above the solid additions to science supplied by the numerous editions of his popular works, it is not needful to make mention here. Enough is gained if at this time these few lines recall some of the services to which Sir Charles Lyell devoted a long, honourable, and illustrious life, which have graven his name in large letters on the front of the temple of science, and in memory of which that name will long be remembered with gratitude and enthusiasm as a watchword among the students of geology.

ARCHIBALD GEIKIE

WATTS' DICTIONARY OF CHEMISTRY

A Dictionary of Chemistry and the Allied Branches of other Sciences. By Henry Watts, B.A., F.R.S., &c. Second Supplement. (Longmans, Green, and Co., 1875.)

THE appearance of the second supplement to Watts' "Dictionary of Chemistry" is an event in the history of chemical literature which will certainly be welcomed by all English chemists. Although it may be said with truth that no great generalisations have been made of late years in chemistry, the science is nevertheless advancing with gigantic strides so far as the accumulation of facts is concerned. Perhaps no science possesses such an extensive journalistic literature as Chemistry; month after month the journals of the Chemical Societies of London and Berlin, the *Gazzetta Chimica Italiana*, the *Annalen der Chemie*, *Poggendorff's Annalen*, the *Annales de Chemie*, the proceedings and transactions of the various learned Societies, as well as numerous smaller chemical publications, all contribute to the vast store of facts already recorded. It is not to be wondered, then, that during the nine years which Mr. Watts devoted to the compilation of his dictionary, the science should have continued its growth at such a pace that the author found it necessary to promise on the completion of the work (Preface to Vol. V., 1869) a supplementary volume bringing the record of discovery down to the existing state of knowledge. The first supplement accordingly appeared in 1872, bringing the history of the science down to the end of 1869. The volume now before us carries the record of discovery down to the end of 1872, and includes some of the more important discoveries made in 1873 and 1874.

From the contents of the present supplement we cannot select more than a few of the longer articles for notice here.

Turning first to the article on benzene, one cannot fail to be struck with the rapid growth of our knowledge of this body and its derivatives within the last few years. The list of haloid, nitro-haloid, &c., derivatives has been considerably increased since the publication of the last supplement by the discovery of new isomeric modifications of these bodies—modifications the discovery of which cannot but be regarded as signal triumphs to chemical theory when we call to mind the fact that the impetus given to the study of benzene, the fundamental hydrocarbon of the aromatic series, arose from the theoretical speculations of Kekulé and his school.

The subject of capillarity is treated of with considerable detail in an article some nine pages in length. The development of this subject is due to the researches of Quincke, Karmarsch, Buliginsky, Valson, and others. The article on chemical action contributes much of importance to the subject: we may particularly mention Mill's researches on the co-efficient of chemical activity, the numerous researches by Berthelot, in conjunction with Jungfleisch on the division of a body between two solvents, and with St. Martin on the state of salts in solution; likewise Favre and Valson's experiments on crystalline dissociation. Passing on to the cinchona alkaloids, we find that three new substances—quinamine, paricine, and paycine—have been added to the list by Hesse. The "constitution" of these cinchona alkaloids is among the problems still awaiting solution at the hands of chemists—may it not be hoped that the synthesis of quinine will one day—as that of alizarine—be a chemical possibility? In electricity, the chief additions to our knowledge are Becquerel's experiments on electro-capillary action, Quincke's theory of electrolysis, and Guthrie's experiments on the relationship between heat and electricity. The mechanical theory of gases has developed into a separate article of considerable importance in our eyes.

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Avogadro's law—the safest foundation on which to build modern chemistry—is directly deducible from the fundamental equation of Clausius :—

$$p = \frac{nmc^2}{3v}$$

so that not only does our modern system of chemistry rest on a thermodynamical basis, but the future of chemical generalisation—judging from the tendency of recent research—lies in this direction also. The subject of heat has received great additions ; the laborious determinations of the specific heats of solutions by Thomsen furnish material for three pages. The " heat of chemical action " has developed enormously through the labours of Thomsen, Hautefeuille, Ditte, and Marignac. Berthelot has also contributed largely to the subject by his thermochemical researches. In industrial chemistry we find much valuable matter added to the metallurgy of iron, the article bringing us down to the invention of Siemens' rotative furnace for obtaining malleable iron and steel directly from the ore. In light, perhaps the most substantial additions to science are to be found in Gladstone's calculations of refraction equivalents, Christiansen, Kundt, Soret, and Sellmeier's researches on anomalous dispersion, and Rammelsberg's researches on the relations between circular polarisation and crystalline form. The articles on the chemical action of light and spectral analysis, contributed by Prof. Roscoe, are excellent *résumés* of the present state of knowledge in these branches of chemical physics. In the latter subject great progress has been made through the labours of Lockyer (discovery of long and short lines in metallic spectra), Roscoe and Schuster (new absorption spectra of potassium and sodium), and Lockyer and Roberts (new absorption spectra of various metals—suggestions for a possible quantitative spectrum analysis).

Prof. G. C. Foster contributes the article on magnetism, and Prof. Armstrong that on the phenols. Most of the articles on physiological chemistry are from the pen of Dr. H. Newell Martin ; and Mr. R. Warington furnishes some valuable articles on subjects relating to agricultural chemistry.

The second supplement exhibits all the care and painstaking conscientiousness of the former volumes, and will be found of invaluable service both to teachers and workers. The names of Mr. Watts and his coadjutors sufficiently guarantee the reliability of the work ; the " Dictionary " has in fact justly taken its rank as one of the standard works of reference in this country.

Seeing that the results of chemical research are flowing into the scientific world in a continuous and ever increasing polyglot stream, both professors and students of the science are indebted to Mr. Watts for the laborious task which he has accomplished for their benefit.

For our own part we look with eager interest upon the continuous encroachment of physics upon chemistry, and venture to hope that the time may not be far distant when generalisation may lead to natural classifications, causing the handbooks and dictionaries of the future to be for the same quantity of information somewhat less bulky in volume.

R. MELDOLA

HIS ON MORPHOLOGICAL CAUSATION

Unsere Körperform und das physiologische Problem ihrer Enstehung. Briefe an einen befreundeten Naturforscher, von Wilhelm His. (Leipzig : Vogel, 1875. London : Williams and Norgate.)

THIS is not, as might perhaps (from its title and from a hasty glance at its contents) be imagined, a popular exposition of the main facts of Embryology as ordinarily understood. Prof. His has been led by his researches to adopt peculiar views concerning the causation of animal forms. These he has explained at some considerable length in his great work on the " Development of the Chick," and elsewhere, but they have not met with very general acceptance ; and the little work we are noticing has for its object a popular and somewhat fuller explanation of these views, and a defence of them against various critics. Among these critics the most conspicuous is Haeckel, whose, to say the least, severe remarks on the author have occasioned a very spirited retaliation. In fact the work, small as it is and popular as it is intended to be, is very largely controversial ; and it has always appeared to us a sign of weakness when a scientific combatant brings his quarrel before a general public.

Without going at all fully into the views of our author, we may say that he strives to explain many of the facts of animal morphology by the agency of mechanical causes acting directly on the growing germ or embryo. Thus, for him the large eyes of the young chick are the direct cause, by compression, of the sharp beak of the bird ; and more generally the unequal tensions produced by unequal growth in the initial flat blastoderm determine, through the agency of certain folds, the form of the animal which springs from it.

As might be expected, many pages of the book are devoted to an attempt at reconciling these views with a modified theory of descent. Speaking broadly, the views of the author may be said to differ from those generally entertained, chiefly on the question whether it is the horse which pulls the cart or the cart the horse, or perhaps rather on the point which is the cart and which the horse. We very much fear that Prof. His's horse is really the cart.

M. F.

OUR BOOK SHELF

Bristol and its Environs, Historical and Descriptive. Published under the sanction of the Local Executive Committee of the British Association. (London : Houlston and Sons. Bristol : Wright and Co., 1875.)

IT was some time ago announced that a Guide to Bristol was being prepared for visitors to the British Association Meeting. This is now published, and appears as an 8vo volume of 475 pages bound in cloth. In many respects the local committee have made great exertions to make the visit in every way a pleasant one, and this has been pretty well known, but so voluminous a guide as this is certainly a surprise. It is well got up, and is illustrated both with views of the buildings in the town and with diagrams illustrative of the geology of the district. Many pens have been employed in its preparation. " The contributions," the Introduction states, " are honorary—the several authors have written with pure love of their subject, and for the sake of doing homage to the occasion that has called forth the volume."

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